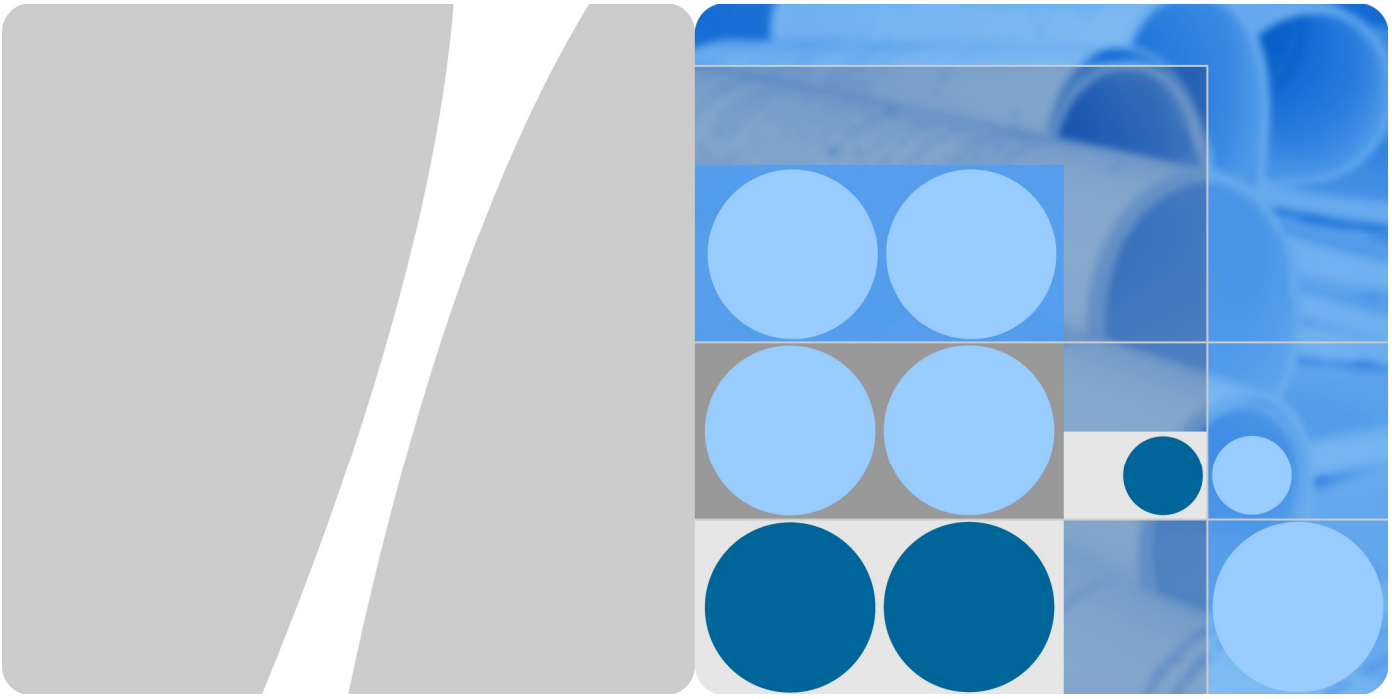

SmartAX MA5662 Multi-Service Access Module
V800R202

Product Description

Issue 01

Date 2010-02-25

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Product Version

Product Name	Product Version
OLT	V800R007 and V800R062
MA5662	V800R202
U2000	V100R002C01

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Contents

Figures

Tables

1 Product Positioning and Features

1.1 Product Positioning

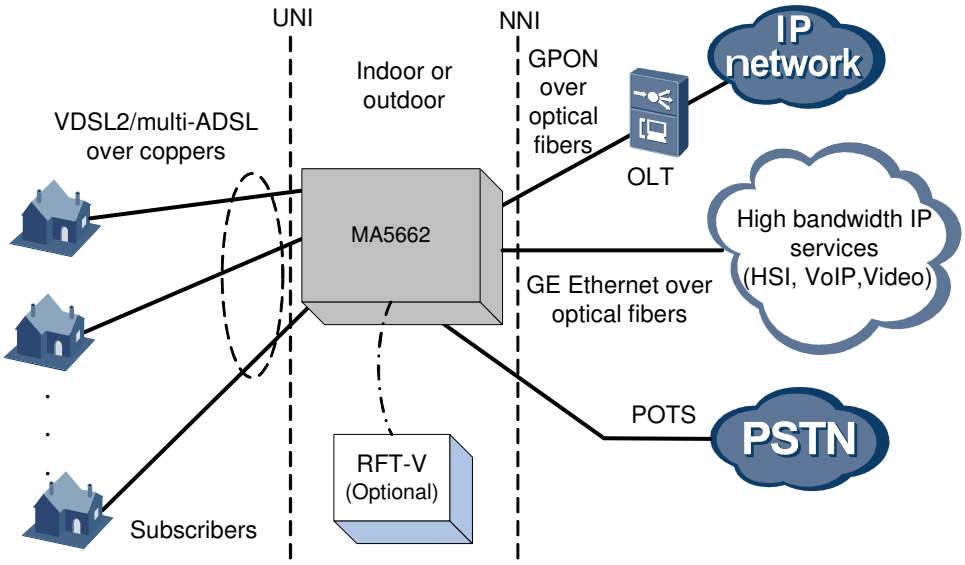
The MA5662 is an outdoor SFF-SU (Small Form Factor-Sealed Unit) multi-service access product of Huawei that supports integrated broadband and narrowband access.

When the MA5662 transmits data upstream through the GE optical port, the MA5662 functions as an IP-DSLAM. When the MA5662 transmits data through the Gigabit-capable Passive Optical Network (GPON) port, the MA5662 functions as a Multi Dwelling Unit (MDU), which, together with the Optical Line Terminal (OLT), constitutes Fiber To The Building (FTTB) network for accessing home users.

Typical Networking

In the upstream direction, the MA5662 uses the GE optical port or GPON port (the GPON port is connected to the OLT, and the OLT transmits data upstream through the GE port) to connect to the IP network. In the downstream direction, the MA5662 provides access for copper-based VDSL2 (compatible with ADSL/ADSL2/ADSL2+) subscribers.

Figure 1-1 Example network of the MA5662



In this network application shown in Figure 1-1, the triple-play service with high bandwidth and high quality is provided over a subscriber line through MA5662. The integrated services include:

- High Speed Internet (HSI) service mixed with POTS service
- Video service (IPTV or VOD)

Device Deployment

The MA5662 is temperature-hardened and highly water-proof. Therefore, it can work normally in harsh outdoor environments. In addition, the MA5662 can be flexibly installed indoors or outdoors.

- Operating temperature: –40°C (cold start) to +70°C
- Cable connection: use of connectors to facilitate installation and device replacement.
- IP protection class: IP66

In outdoor environment, the MA5662 can be quickly installed by making full use of the available buildings and cabinets. In general, the MA5662 can be:

- Installed against a wall
- Installed against a pole
- Installed on a wooden post.
- Mounted to the outside of an outdoor cabinet
- Mounted to the inside of an outdoor cabinet

1.2 Product Features

1.2.1 Superior Maintainability and Manageability

The MA5662 provides comprehensive maintenance, management, and monitoring functions that facilitate routine maintenance tasks and fault detection operations.

One-Site Deployment and Plug and Play

The MA5662 supports:

- Offline deployment and plug and play.

  The hardware installation engineer completes the device deployment for the first time on the site.
- Automatic obtaining of the configuration from the network management system (NMS), automatic effectuation of the configuration, and automatic report of the online of MxU to the NMS.

Various Maintenance Methods

The MA5662 features the following:

- Maintenance compartment designed to facilitate:
  - Replacement of an optical transceiver
  - Replacement of a protective unit

  - Software commissioning
- Remote maintenance through the secure SSH CLI
- Management based on Simple Network Management Protocol Version 1 (SNMPv1), SNMPv2, and SNMPv3 through the NMS
- Ethernet OAM based on IEEE 802.1ag
- In-service features:
  - In-service reporting of hardware and software versions
  - Real-time in-service upgrading or loading of the software
  - Real-time in-service loading and management of software patches
- Loop-back test of the VDSL2 line, which helps to quickly isolate the area where a network fault occurs, thus improving fault diagnosis efficiency and reducing the maintenance cost
- Single-ended Loop Testing (SELT) and line capture functions
- Diagnosis of the link between the OLT and the MDU (including the fiber test diagnosis and link test), multiple types of SBIs provided through the NMS for the managed objects to implement rich network element (NE) management.
- SNMP interface

  The operator can log in to MA5662 from the NMS through the SNMP interface to configure, manage, and maintain the MA5662.
- TFTP/FTP/SFTP interface

  The operator can back up the configuration data, upgrade the software version, and load software patches for the MA5662 from the maintenance terminal through the TFTP/FTP /SFTP interface.
- Telnet interface

  The operator can log in to the MA5662 from the maintenance terminal through the Telnet interface to configure, manage, and maintain the MA5662.

Terminal Management

The MA5662 supports centralized management and maintenance on the VDSL2 modems as follows:

- Querying the information about the modems
- Monitoring the status of the modems

Security Authentication Management

The NMS provides various authentication management modes to meet different operation and maintenance requirements.

- When a user performs an operation, the system restricts this operation according to the rights to the user, and then according to the rights to the operations.
- After a user passes the authentication and logs in, the menus for the unauthorized operations are unavailable.

In addition, the devices that the user is not authorized to operate are shielded from the management interface.

External Alarm Management

The MA5662 provides the external alarm function for door status monitoring. In this way, the external input ON/OFF information (door status alarms) can be collected. This helps implement remote or unattended maintenance of the MA5662.

The MA5662 supports Boolean value alarm through which the external devices, such as Uninterruptible Power Supply (UPS) and battery, can be monitored.

The MA5662 also supports input of 16 types of the external alarms, thus meeting the requirements specified in the R3-7 standards.

Network Management

The MA5662 provides the following network management functions:

- Automatic back up of the new configuration files of the MDU to the NMS in a centralized mode. In the case of MDU replacement or MDU upgrade failure, the system automatically obtains the backup configuration file to recover the user configuration data.
- User-defined upgrade policy for the automatic batch upgrade of the NE at a specified time.
- Wizard-based operation, simple and convenient.
- Offline adding and configuring of MDU, and automatic configuring of the configuration information after the MDU is powered on and gets online.
- Remote commissioning, including loop test on the PE port and multicast service emulation.
- LOS alarm and Dying gasp alarm (Dying gasp: The system detects the output of the MDU power module. If the voltage drops below the threshold, the system generates an alarm), and differentiation of the cause of MDU out-of-control between fiber break and power failure.
- Remote reset of the system.
- Self-healing. After the MDU dynamic resources are exhausted, the system automatically resets.
- Polling of the NMS through the OLT.
- Detection and protection of the continuous light source of the MDU. If an MDU gives out light when it should not give out light, this affects the communication of another MDU or all the MDUs and may result in PON system crash.

Software Upgrade

The MA5662 supports in-service upgrade in addition to version rollback in case of an upgrade failure.

You can upgrade the software through either of the following methods:

- A serial port based on Xmodem
- An Ethernet port based on TFTP, SFTP, or FTP

To ensure the reliability and security, Huawei developed an effective upgrade tool called Data Center (DC) work with the NMS and the MA5662.

- This solution features higher efficiency and improves the reliability of software upgrade.

- The MA5662 can download software from an FTP server.
- The DC can be used to control the batch upgrade of MA5662s through the SNMP interface.
- The upgrade solution meets the requirements for carrier-class operations, and it is widely applied by TOP carriers.

Performance Measurement

The MA5662 supports the querying of the following performance data:

- Multicast streams, multicast VLAN packets, and multicast user packets
- VLAN traffic streams and network flow
- Number of packets and flow of the Ethernet port
- Cell flow and byte flow of the service port
- VDSL2 CO-side line, user-side line, CO-side abnormity, user-side abnormity, and traffic

1.2.2 Carrier-Class Reliability

The system reliability is taken into consideration in the system, hardware, and software designs to ensure the reliable running of the MA5662.

System Design

The system design of theMA5662 has the following reliability features:

- In compliance with the carrier-class reliability design
- Comprehensive exception handling capability
- Self-healing to automatically avoid fan maintenance and fan faults
- Passed the electrostatic discharge (ESD) test
- Providing lightning protection and anti-interference functions
- Providing diverse alarm information for quick and accurate fault detection and rectification
- Remote maintenance
- CPU overload control
- Preventing excessive exhaustion of the system resources, ensuring that overload does not interrupt all services, and ensuring the quality of key services to a certain extent when the system is overloaded

Software Design

The following are the reliability features of the software design of the MA5662:

- Complying with the modularized and platform-based design and adopting the loosely coupled design for each software module
- Advanced design methods such as object-orientation, fault tolerance, fault rectification, and automatic recovery
- Capability maturity model (CMM) management
- In-service software loading

Hardware Design

The following are the reliability features of the hardware design of the MA5662:

- The PSTN voice service is not interrupted when the device is powered off.
- The upstream port supports 1+1 redundancy, namely, the link aggregation group (LAG).
- The customer facing interface meets the protection requirements of GR 1089.
- The hardware design supports the 4 kV surge protection of the DSL port.

Networking Reliability Design

Multiple Spanning Tree Protocol (MSTP) protection and trunk function on GE ports are provided. When a link is faulty, the MSTP protocol provides a loop free connected network.

1.2.3 Powerful QoS

The MA5662 supports the prioritization of traffic streams and ensures quality of service (QoS) for different services.

The MA5662 supports the following powerful QoS capabilities:

- Transmits the data and network management streams upstream through different VLANs, thus logically separating traffic of different types
- Tags the voice, data, and network management streams with different ToS/DSCP priorities, thus providing a prioritized forwarding mechanism based on L3
- Tags the voice, data, and network management streams with different 802.1p priorities, thus providing a prioritized forwarding mechanism based on L2
- Guarantees QoS for the voice service through the following points:
  - Queue scheduling
  - IP type of service (ToS/ DSCP)
  - IEEE 802.1Q
- Supports the Access Node Control Protocol (ANCP). By interchanging messages with the BRAS, the MA5662 provides the following functions:
  - Topology discovery of the ports of the access device
  - xDSL line configuration
  - Layer 2 Control Protocol (L2CP) OAM
  - Dynamic adjustment of multicast bandwidth
- Supports two rate three color marker (trTCM)-based IP traffic profile, and rate limitation on subscriber port
- Supports priority control based on the service traffic
- Supports priority mapping and modification based on the ToS/DSCP field and 802.1p
- Supports bandwidth control based on the service traffic, with a control granularity of 64 Kbit/s
- Supports Strict-Priority Queue (SP), Weighted Round Robin (WRR), and SP + WRR
- Supports the following QoS strategies based on traffic rules:
  - Packet filtering
  - Packet redirection
  - Flow mirroring

  - Traffic statistics
  - Traffic shaping
  - Bandwidth control
  - Priority tagging
- Supports flexible service mapping
  - QinQ VLAN
  - VLAN stacking
  - Link Aggregation Control Protocol (LACP)
- Supports the bandwidth management based on dynamic bandwidth allocation (DBA) through the GPON port.
- Supports the priority service based on each TCONT in the upstream GPON of the MDU. Each service port has four class of service (CoS) priority queues with numbers 0–3. Queue 3 enjoys the highest priority and queue 0 has the lowest priority.

1.2.4 Strict Security

To meet the security requirements of carrier-class telecom services, the MA5662 provides the following features to ensure the security of the system and the user.

System Security

The MA5662 provides the following system security measures:

- Prevention of denial of service (DoS) attacks
- Media access control (MAC) address filtering
- SNMPv3 for system management
- Security mechanism based on the user-based security model (USM)
- Secure Shell Version 2 (SSHv2) for security authentication upon the login of maintenance and management staff
- Secure data loading and backup through the Secure File Transfer Protocol (SFTP)
- Remote authentication dial in user service (RADIUS) authentication of maintenance and management staff
- Hierarchical rights control, that is, different rights for maintenance and management staff at different levels
- Firewall blacklist
- GEM-port-based encryption of downstream packets through the PLOAM message by using the advanced encryption standard (AES) 128-bit algorithm
- Dynamic key switching that complies with ITU-T G.984 through the PLOAM message
- IEEE 802.3ah
  - Supports transceiving and processing of Information OAMPDU packets to carry out OAM Discovery and obtain the terminal vendor information.
  - Supports resolution of the received Event Notification OAMPDU packets.

User Security

The MA5662 provides the following user security measures:

- IEEE 802.1X user access authentication

- L2 user isolation and controlled mutual access
- Dynamic Host Configuration Protocol (DHCP) Option82 to enhance the DHCP security
- Binding between MAC/IP addresses and port IDs
- Policy Information Transfer Protocol (PITP) to identify users by the physical port information
- Anti-IP spoofing
- Anti-MAC spoofing based on VLAN
- Query of the IP address of a port by its MAC address

1.2.5 Operable IPTV Service

The MA5662 supports the following carrier-class multicast capabilities:

- Large switching capacity with a powerful switching system
- High IGMP packet forwarding rate
- High integration of data switching, routing, and user management functions

The MA5662 provides flexible multicast solutions by supporting Internet Group Management Protocol Version 2 (IGMPv2) and IGMPv3 on the user side interface and the network side interface. This lays the foundation for operability and manageability of broadband multicast services.

Multicast Protocols

- IGMPv2 and IGMPv3
- IGMP proxy and IGMP snooping

Multicast Service

- Up to 1000 concurrent multicast streams of the system
- Up to 32 concurrent multicast streams of each user
- Up to 256 multicast users of the system
- Up to 4096 configured multicast programs of the system
- Configurable maximum number of the preview times in a day
- Audience statistics
- IGMP pre-join, quick-leave, and high performance processing, which enables the broadband TV (BTV) service
- Managing of the programs and users based on the multicast VLAN
- Dropping of downstream broadcast packets, unknown unicast packets, and unknown multicast packets on a line card based on the VLAN

Multicast User Management

- Multiple multicast authority profiles for users to control user rights, such as **watch**, **preview**, **forbidden**, and **idle**.
- Connection admission control (CAC) for multicast users to ensure that authenticated users enjoy high-quality services

2 Product Architecture

2.1 Appearance and Layout

This topic describes appearance and dimensions of the MA5662 with ANSI and ETSI as examples.

Appearance

Figure 2-1 shows the appearance of the MA5662.

Figure 2-1 Appearance of the MA5662

Layout

Figure 2-2 and Figure 2-3 show the layout of the MA5662.

Figure 2-2 Layout of the MA5662 for ANSI

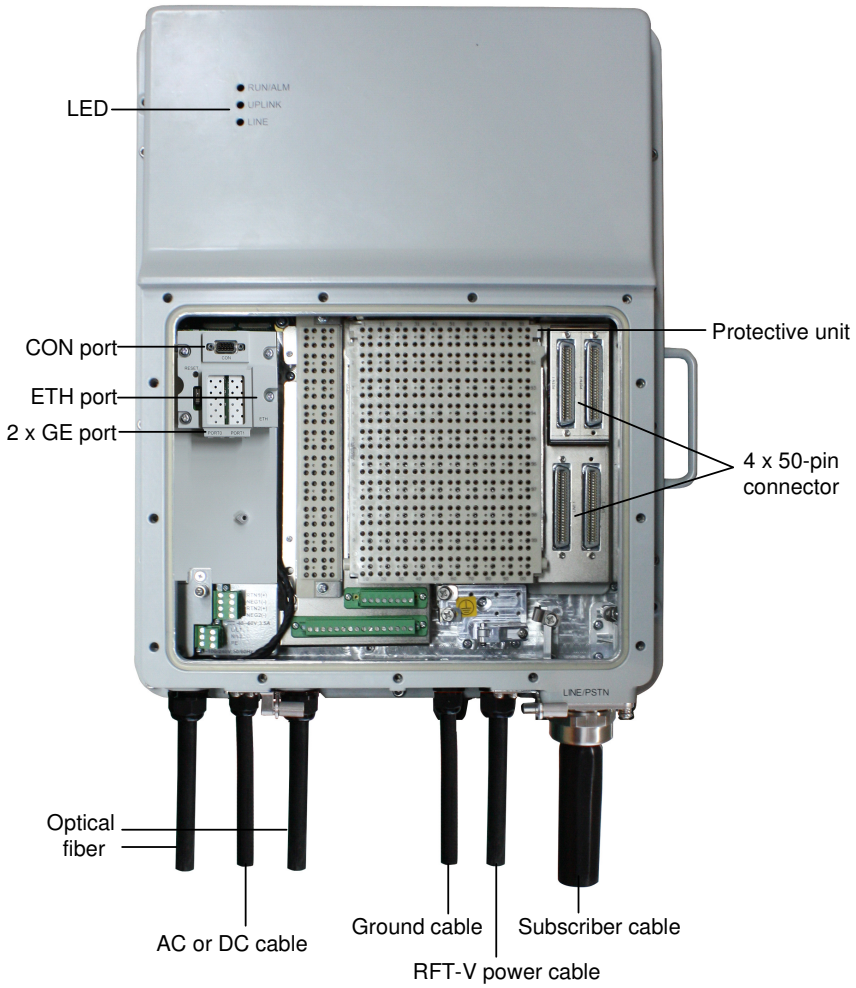


Table 2-1 Description of major components

Standard Compliance	Component	Description
North Amenrican ANSI	Three-in-one power supply	Supports any of the local DC power supply, local AC power supply, and remote DC power supply. **CAUTION** The use of any two power supply modes at the same time is forbidden.
	GE port	Supports upstream transmission through two GE ports.
	CON port	It is connected to the DB-9 port on a console through a serial cable for local or remote maintenance.
	ETH port	It is connected to a terminal through an RJ-45 port for local or remote maintenance.
	PGND cable	The device is grounded in a centralized manner through the grounding lug of the device shell.

Standard Compliance	Component	Description
	Fiber spooling box	This box is used to spool redundant optical fibers (it is not marked in Figure 2-2).
	Fiber cable	• Two cables are for upstream, or one is for upstream, the other is for subtending. • The two GE ports are corresponding with the two fiber cables.
	Protective unit	The 60-pin AMP Champ connector is used to connect to the VDSL2 subscriber cable to fit in the ANSI application scenarios.
	Subscriber cable connector	When the protective unit is used to lead in subscriber cables, the 50-pin AMP Champ connectors are used to facilitate cable installation and device replacement.

Figure 2-3 Layout of the MA5662 for ETSI

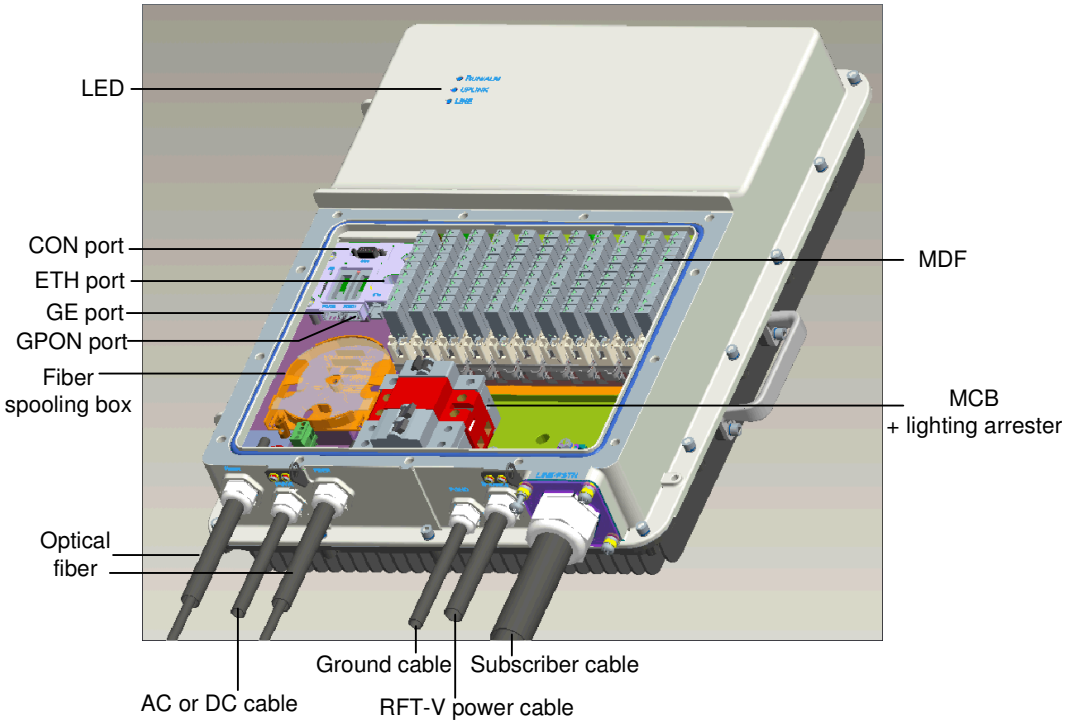


Table 2-2 Description of major components

Standard Compliance	Component	Description
European ETSI	Three-in-one power supply	Supports any of the local DC power supply, local AC power supply, and remote DC power supply. **CAUTION** The use of any two power supply modes at the same time is forbidden.
	GE port	Supports upstream transmission through one GE port.
	GPON port	Supports upstream transmission through one GPON port.
	CON port	It is connected to the DB-9 port on a console through a serial cable for local or remote maintenance.
	ETH port	It is connected to a terminal through an RJ-45 port for local or remote maintenance.
	PGND cable	The device is grounded in a centralized manner through the grounding lug of the device shell.
	Fiber spooling box	This box is used to spool redundant optical fibers.
	Fiber cable	• Two cables are for upstream, or one is for upstream, the other is for subtending. • The two GE ports are corresponding with the two fiber cables.
	MDF	Directly connects to VDSL2 subscriber cables.
	MCB + lighting arrester	Protects the power cables from lightning strikes. The MCB and lighting arrester are mandatory when the local power supply and the MDF are used.

Status LEDs

Table 2-3 describes the LED status of the MA5662.

Table 2-3 LED status of the MA5662

Indicator	Color	Description
RUN/ALM	Green flashing (0.25s on and 0.25s off repeatedly)	Device is starting up.
	Green flashing (1s on and 1s off repeatedly)	Device is working in the normal state.
	Red on	Device is in faulty.

Indicator	Color	Description
UPLINK	Green on	Uplink is activated.
	Green flashing(0.25s on and 0.25s off repeatedly)	Uplink is receiving and transmitting data.
	Off	Uplink is not activated.
LINE	Green on	Downlink is activated.
	Green flashing(0.25s on and 0.25s off repeatedly)	Downlink is receiving and transmitting data.
	Off	Downlink is not activated.

2.2 Ports

The MA5662 provides various ports to adapt to different network conditions. Table 2-4 provides the upstream ports and service port of the MA5662. Table 2-5 provides the maintenance ports of the MA5662. Table 2-6 and Table 2-7 provide the port specifications of upstream GE port and VDSL2 line port. Table 2-8 provides the GPON port of the MA5662.

Port Type and Capacity

Table 2-4 Upstream port and Service port on the MA5662

Type	Description	Specification
Upstream port	**GE optical port**: • Uses the small form-factor pluggable (SFP) transceiver. • Through different SFP transceivers, the optical ports support different transmission distances. • Both single-mode and multi-mode SFP transceivers are available.	Complies with: 1000Base-Sx, 1000Base-Lx, and 1000Base-Zx. See Table 2-6 for details.
	GPON optical port: • Uses the single-mode transceiver and supports bidirectional data transmission over one optical fiber. • The optical connector used is SC/PC type.	Complies with the series of ITU G.984 standards. See Table 2-8 for details.
Service port	**VDSL2 over POTS port**: • The VDSL2 port complies with ITU-T G.993.2. • The VDSL2 port supports the maximum transmission distance of 3.5kg (2.17mi).	Complies with ITU-T G.993.2 See Table 2-7 for details.

Table 2-5 Maintenance ports on the MA5662

Port Type	Mnemonic	Description	Connector
Maintenance serial port	CON	A RS-232 serial port connected with a console for local or remote maintenance	DB-9
Maintenance Ethernet port	ETH	A 10/100 Mbps Ethernet port connected with a console for local or remote maintenance	RJ-45
Boolean value alarm port	ALM	An external device, such as UPS and battery, connected with a RFT-V power and monitoring cable can be monitored.	a RFT-V power and monitoring cable

GE Optical Port Specifications

Table 2-6 Specifications of the GE optical ports

Parameter	1000Base-Sx	1000Base-Lx	1000Base-Zx	1000Base-Zx
Connector type	LC	LC		LC
Media	MMF	SMF	SMF	SMF
Distance	Max. 500 m	Max. 10 km	Max. 40 km	Max. 80 km
Fiber core diameter (μm)	50 /125(1)	9 /125(1)	9 /125(1)	9 /12(1)
Wavelength	850 nm	1310 nm	1550 nm	1550 nm
TX power (dBm)	–9.5 to 0	–9 to –3 or –9.5 to –3(2)	–4 to +1	–2 to –5
RX sensitivity (dBm)	Max.–17	Max.–20	Max.–23	Max.–23
Extinction ratio (dB)	9	9	9	9
Standard compliance	IEEE 802.3z	IEEE 802.3z	IEEE 802.3z	IEEE 802.3z

NOTE

- The first number represents the internal diameter of a fiber core, and the second number represents the external diameter of a fiber core.
- The TX power parameter is related to the specific optical module used.

VDSL2 Over POTS Port Specifications

Table 2-7 Specifications of the VDSL2 over POTS port

Parameter	Specifications
The maximum transmission rate (17a)	• Downstream net rate: 80 Mbps–90 Mbps • Upstream net rate: 40 Mbps–50 Mbps
Connector type	50-pin cable connector (for ANSI)
Maximum transmission distance	3500 m (2.2 miles) when U0 mode is enabled
Cable type	Twisted pairs
Modulation	DMT
Service supported	VDSL2 over POTS
Frame protocol supported	ATM or PTM
Standard compliance	ITU-T G.993.2

GPON Port Specifications

Table 2-8 Specifications of the GPON port

Parameter	Specifications
Transmission rate	• Receive rate: 2.488 Gbit/s • Transmit rate: 1.244 Gbit/s
Port mode	Single mode
Port type	SC/PC
Maximum transmission distance	20 km
Standard compliance	ITU-T G.984.2 CLASS B+
Center wavelength	Receive wavelength: 1490 nm Transmit wavelength: 1310 nm
Transmit optical power	0.5 dBm–5.0 dBm
Extinction ratio	Greater than 10 dB
Maximum receiver sensitivity	–27 dBm
Overload optical power	–8 dBm

2.3 Power Supply

The MA5662 can be flexibly installed. Therefore, it needs to support multiple power supply modes. To fit in various environments, the MA5662 supports the three-in-one power supply mode:

- Local DC power supply
- Local AC power supply
- Remote DC power supply (RFT-V)

Customers can select any of the preceding three power supply modes according to their actual requirements. "three-in-one" indicates that the MA5662 can use any of the preceding power supply modes through its unified power module.

In principle, which power supply mode is selected is determined by the actual installation environment of the MA5662. If there is neither local DC power supply nor local AC power supply, the DC power supply from the remote office can be used through the twisted pair. Table 2-9 lists the power modes complying with the ETSI standards. Table 2-10 lists the power modes complying with the ANSI standards.

Table 2-9 ETSI-compliance power supply mode

Power Supply Mode	Voltage Range	Requirements on Lightning Protection
Local DC	–48 V (–38.4 V to –72 V)	No lighting protection fittings are required.
Local AC	220 V (90 V to 264 V)	The protective unit is not required but the MCB and the lightning arrester must be configured.

Table 2-10 ANSI-compliance power supply mode

Power Supply Mode	Voltage Range	Requirements on Lightning Protection
Local DC	–48 V (–38.4 V to –72 V)	No lighting protection fittings are required.
Local AC	110 V (90 V to 264 V)	The protective unit is required but the MCB and the lightning arrester are not configured.
Remote DC (RFT-V)	+/–190V (140 V to 380 V)	The protective unit is required.

2.4 Cable and Connector

This topic describes the appearance of the MA5662 cable, connections, application, and technical parameters.

2.4.1 DC Power Cable

Connection

The DC power cable connects the power port of the chassis to the external power supply in the following modes:

- One end of the cable is connected to the DC input of the power port of the chassis.
- The other end is connected to the output of the three-in-one power supply.

Technical Parameters

Table 2-11 describes the technical parameters of the DC power cable.

Table 2-11 Technical parameters of the DC power cable

Parameter	Description
Cable type	Electronic power cable
Connector (X1/X2)	A cord end terminal is used on the MA5662 side and the connector type used on the other side depends on the on-site requirement.
Wire gauge of the inner conductor (North America)	16 AWG
Sectional area of the conductor (Europe)	1.5 mm^2

2.4.2 AC Power Cable

Connection

The AC power cable provides the working voltage for the chassis. The connection is as follows:

- One end of the cable is connected to the AC input of the power supply of the chassis.
- The other end is connected to the output of the three-in-one power supply.

Technical Parameters

Table 2-12 describes the technical parameters of the AC power cable.

NOTE

The AC power cable varies according to different countries and areas. This chapter takes the Chinese standard AC power cable as an example.

Table 2-12 Technical parameters of the AC power cable

Parameter	Description
Function description	GB 250 VAC/10 A
Connector (X1/X2)	A cord end terminal is used on the MA5662 side and the connector type used on the other side depends on the on-site requirement.
Cable type	External power cable
Wire gauge of the inner conductor (North America)	16 AWG
Sectional area of the conductor (Europe)	1.5 mm^2

2.4.3 RFT-V Power and Monitoring Cable

Connection

RFT-V power and monitoring cable provides the working voltage for the chassis. The connection is as follows:

- One end of the cable is connected to the input of the remote power supply.
- The other end is connected to the output of the three-in-one power supply.

Pin Assignments

Table 2-13 shows the pin assignments of the RFT-V power and monitoring cable.

Table 2-13 Pin assignments of the RFT-V power and monitoring cable

No.	Color	Relation	No.	Color	Relation	No.	Color	Relation
1	White	RFT0	9	White	RFT4	17	Red	No use
2	Blue		10	Gray		18	Brown	
3	White	RFT1	11	Red	RFT5	19	Red	
4	Orange		12	Blue		20	Gray	
5	White	RFT2	13	Red	RFT6	21	Black	
6	Green		14	Orange		22	Blue	
7	White	RFT3	15	Red	RFT7	23	Black	
8	Brown		16	Green		24	Orange	

Technical parameters:

Table 2-14 describes the technical parameters of the RFT-V power and monitoring cable.

Table 2-14 Technical parameters of the RFT-V power and monitoring cable

Parameter	Description
Connector (X1/X2)	A cord end terminal is used on the MA5662 side and the connector type used on the other side depends on the on-site requirement.
Cable type	External power cable
Wire gauge of the inner conductor (North America)	24AWG

2.4.4 PGND Cable

Connection

The protection grounding (PGND) cable is used for protection against the lightning and interference for the chassis. The connection is as follows:

- One end of the PGND cable is connected to the grounding bar of the cabinet.
- The other end is connected to the grounding terminal of the cabinet.

Technical Parameters

Table 2-15 describes the technical parameters of the PGND cable.

Table 2-15 Technical parameters of the PGND cable

Parameter	Description
Cable type	Electronic power cable
Connector (X1/X2)	Dual-OT terminal/ Dual-OT terminal
Wire gauge of the inner conductor (North America)	6AWG
Sectional area of the conductor (Europe)	10 mm^2
Maximum current	59.9 A

2.4.5 Optical Fiber

Connection

The optical fiber is used to carry the optical signals, and is applied for the long distance transmission of the optical signals. The connection is as follows:

- One end of the optical fiber is connected to the optical interface of the board.
- The other end is connected to the ODF of the optical fiber, optical interface of the upstream device, or optical interface of other devices.

Appearance and Structure

The single-mode optical fiber is the same as the multi-mode optical fiber in appearance, but different from the multi-mode optical fiber in color. The yellow optical fiber is single-mode optical fiber and the orange optical fiber is multi-mode optical fiber.

Figure 2-4 show the appearance of the single-mode optical fiber with SC/PC connectors as an example.

Figure 2-4 Appearance of the single-mode optical fiber with SC/PC connectors

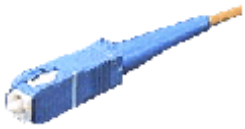
Optical Fiber Selection Criteria

Table 2-16 shows the optical fiber selection criteria. Table 2-17 shows the common connectors.

Table 2-16 Optical fiber selection criteria

Parameter	Selection Criteria
Length	Survey result
Single-mode/multi-mode	Transceiver type. The MA5662 uses the single-mode optical fiber.
Optical connector type	Square connector: SC/PC, LC/PC, and MTRJ/PC. Round connector: ST/PC, and FC/PC.

Table 2-17 Common optical connectors

 SC/PC optical connector	 LC/PC optical connector
 FC/PC optical connector	 MTRJ/PC optical connector
 ST/PC optical connector	-

2.4.6 VDSL2+ Subscriber Line

Connection

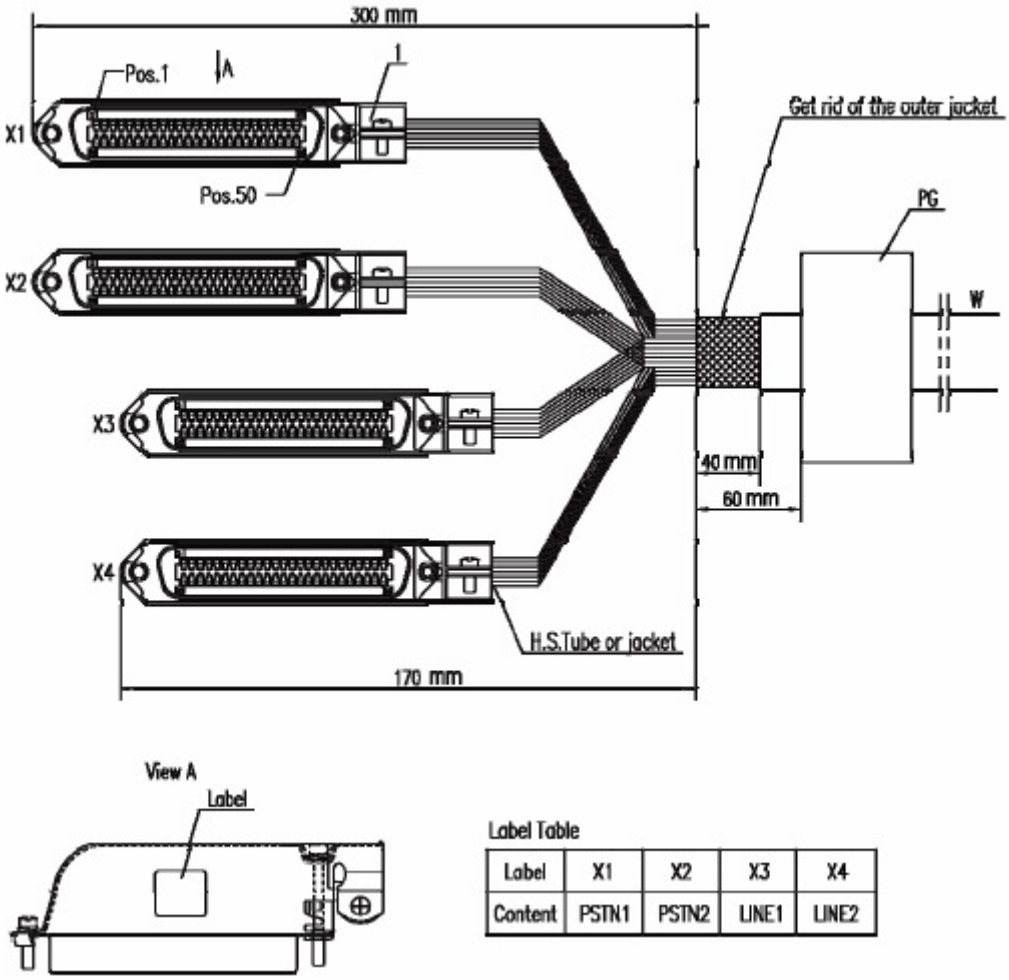
VDSL2+ subscriber line connects the POTS port to the MDF in the following connection mode:

- One end of the VDSL2+ subscriber line is connected to the POTS port.
- The other end is connected to the MDF.

Structure

Figure 2-5 shows the structure of the VDSL2+ subscriber line.

Figure 2-5 Structure of the VDSL2+ subscriber line



Pin Assignments

Table 2-18 shows the pin assignments of the VDSL2+ subscriber line.

Table 2-18 Pin assignments of the VDSL2+ subscriber line

X1	Group Color	Color	Relation	X1	Group Color	Color	Relation	X1	Group Color	Color	Relation
1	Blue	White	Pair	17	Blue	Red	Pair	34	Blue	Yellow	Pair
2		Blue		18		Brown		35		Orange	
3		White	Pair	19		Red	Pair	36		Yellow	Pair
4		Orange		20		Gray		37		Green	
5		White	Pair	21		Black	Pair	38		Yellow	Pair
6		Green		22		Blue		39		Brown	

X1	Group Color	Color	Relation	X1	Group Color	Color	Relation	X1	Group Color	Color	Relation
7		White	Pair	23		Black	Pair	40		Yellow	Pair
8		Brown		24		Orange		41		Gray	
9		White	Pair	26		Black	Pair	42		Purple	Pair
10		Gray		27		Green		43		Blue	
11		Red	Pair	28		Black	Pair	44		Purple	Pair
12		Blue		29		Brown		45		Orange	
13		Red	Pair	30		Black	Pair	46		Purple	Pair
14		Orange		31		Gray		47		Green	
15		Red	Pair	32		Yellow	Pair	48		Purple	Pair
16		Green		33		Blue		49		Brown	
PSTN 0–7				PSTN 8–15				PSTN 16–23			

X2	Group Color	Color	Relation	X2	Group Color	Color	Relation	X2	Group Color	Color	Relation
1	Orange	White	Pair	17	Orange	Red	Pair	34	Orange	Yellow	Pair
2		Blue		18		Brown		35		Orange	
3		White	Pair	19		Red	Pair	36		Yellow	Pair
4		Orange		20		Gray		37		Green	
5		White	Pair	21		Black	Pair	38		Yellow	Pair
6		Green		22		Blue		39		Brown	
7		White	Pair	23		Black	Pair	40		Yellow	Pair
8		Brown		24		Orange		41		Gray	
9		White	Pair	26		Black	Pair	42		Purple	Pair
10		Gray		27		Green		43		Blue	
11		Red	Pair	28		Black	Pair	44		Purple	Pair
12		Blue		29		Brown		45		Orange	
13		Red	Pair	30		Black	Pair	46		Purple	Pair
14		Orange		31		Gray		47		Green	
15		Red	Pair	32		Yellow	Pair	48		Purple	Pair

X2	Group Color	Color	Relation	X2	Group Color	Color	Relation	X2	Group Color	Color	Relation
16		Green		33		Blue		49		Brown	
PSTN 24–31				PSTN 32–39				PSTN 40–47			

X3	Group Color	Color	Relation	X3	Group Color	Color	Relation	X3	Group Color	Color	Relation
1	Green	White	Pair	17	Green	Red	Pair	34	Green	Yellow	Pair
2		Blue		18		Brown		35		Orange	
3		White	Pair	19		Red	Pair	36		Yellow	Pair
4		Orange		20		Gray		37		Green	
5		White	Pair	21		Black	Pair	38		Yellow	Pair
6		Green		22		Blue		39		Brown	
7		White	Pair	23		Black	Pair	40		Yellow	Pair
8		Brown		24		Orange		41		Gray	
9		White	Pair	26		Black	Pair	42		Purple	Pair
10		Gray		27		Green		43		Blue	
11		Red	Pair	28		Black	Pair	44		Purple	Pair
12		Blue		29		Brown		45		Orange	
13		Red	Pair	30		Black	Pair	46		Purple	Pair
14		Orange		31		Gray		47		Green	
15		Red	Pair	32		Yellow	Pair	48		Purple	Pair
16		Green		33		Blue		49		Brown	
LINE 0–7				LINE 8–15				LINE 16–23			

X4	Group Color	Color	Relation	X4	Group Color	Color	Relation	X4	Group Color	Color	Relation
1	Brown	White	Pair	17	Brown	Red	Pair	34	Brown	Yellow	Pair
2		Blue		18		Brown		35		Orange	
3		White	Pair	19		Red	Pair	36		Yellow	Pair
4		Orange		20		Gray		37		Green	
5		White	Pair	21		Black	Pair	38		Yellow	Pair

X4	Group Color	Color	Relation	X4	Group Color	Color	Relation	X4	Group Color	Color	Relation
6		Green		22		Blue		39		Brown	
7		White	Pair	23		Black	Pair	40		Yellow	Pair
8		Brown		24		Orange		41		Gray	
9		White	Pair	26		Black	Pair	42		Purple	Pair
10		Gray		27		Green		43		Blue	
11		Red	Pair	28		Black	Pair	44		Purple	Pair
12		Blue		29		Brown		45		Orange	
13		Red	Pair	30		Black	Pair	46		Purple	Pair
14		Orange		31		Gray		47		Green	
15		Red	Pair	32		Yellow	Pair	48		Purple	Pair
16		Green		33		Blue		49		Brown	
LINE 0–7				LINE 8–15				LINE 16–23			

Technical Parameters

Table 2-19 describes the technical parameters of the VDSL2+ subscriber line.

Table 2-19 Technical parameters of the VDS2+ subscriber line

Parameter	Description
Connector (X1/X2)	• (North America) A 50-pin cable connector is used on the MA5662 side and the bare wire is used on the other side. • (Europe) No connector is used.
Wire gauge of the inner conductor (North America)	24AWG
Sectional area of the conductor (Europe)	0.3 mm^2

2.4.7 Local Maintenance Serial Port Cable

Connection

The local maintenance serial port cable is used for commissioning or local maintenance. The cable is connected in the following mode:

- One end of the local maintenance serial port cable is an 8-pin RJ-45 connector and it is connected to the maintenance port of the device.

- The other end is DB9 or DB25 socket and it is connected to the maintenance terminal. When a PC works as the maintenance terminal, a DB9 socket is used.

Appearance and Structure

Figure 2-6 shows the appearance of the local maintenance serial port cable.

Figure 2-6 Appearance of the local maintenance serial port cable

2.4.8 Local Maintenance Network Port Cable

Connection

The network cable connects the PC to the maintenance network port on the control board for local maintenance or remote maintenance.

The network cable is classified into straight through cable and crossover cable:

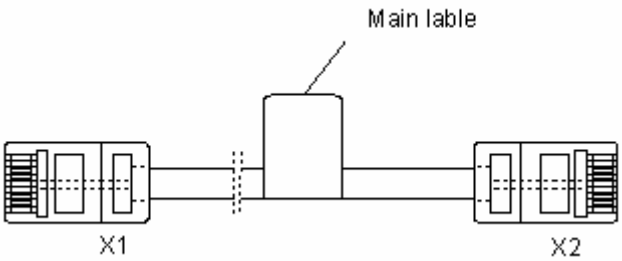
- The straight through cable is used for the communication between the terminal device and network.
- The crossover cable is used for the direct communication between two terminal devices.

Appearance and Structure

The appearance of the straight through cable is the same as that of the crossover cable. Figure 2-7 shows the appearance of the network cable. Figure 2-8 shows the structure of the network cable.

Figure 2-7 Appearance of the network cable

Figure 2-8 Structure of the network cable



Connection

Table 2-20 describes the connection of the straight through cable.

Table 2-20 Connection of the straight through cable

Pin of X1	Core Color	Pin of X2
1	Double-colored: white and orange	1
2	Orange	2
3	Double-colored: white and green	3
4	Blue	4

5	Double-colored: white and blue	5
6	Green	6
7	Double-colored: white and brown	7
8	Brown	8

Table 2-21 describes the connection of the crossover cable.

Table 2-21 Connection of the crossover cable

Pin of X1	Core Color	Pin of X2
1	Double-colored: white and orange	3
2	Orange	6
3	Double-colored: white and green	1
4	Blue	4
5	Double-colored: white and blue	5
6	Green	2
7	Double-colored: white and brown	7
8	Brown	8

NOTE

To acheive good electrical transmission performance, ensure that the wires connected to pins 1 and 2 and to pins 3 and 6 are twisted pairs.

Technical Parameters

Table 2-22 describes the technical parameters of the network cable.

Table 2-22 Technical parameter of the network cable

Parameter	Description
Connector (X1/X2)	RJ-45 connector
Cable type	Category-3 and category-5 unshielded twisted pairs (UTP-3 and UTP-5) or shielded twisted pairs (STP) can be used as network cables
Color	Dark gray
Characteristic impedance	100.0 ohms
Core diameter of the inner conductor	0.510 mm

Parameter	Description
Breakdown voltage	500.0 V
DC resistance of the inner conductor	93.8 ohms
Core number	8
Frequency range	0–100 MHz
Frequency attenuation	22 dB/100 m @ 100 MHz

2.5 Ventilation

The MA5662 supports a high density of user access. Meanwhile, the MA5662 adopts an optimal design to implement the passive cooling instead of fan cooling system.

With the design of passive cooling, the MA5662 has the following advantages.

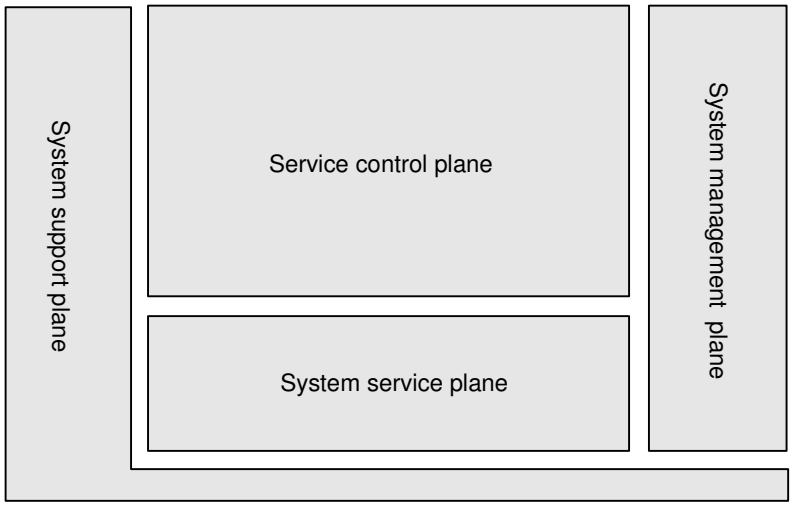
- The noise generated by the device is significantly decreased, which effectively minimizes the noise pollution.
- Fans are low-reliability components. When the device is not configured with a fan, the fault rate decreases significantly, thus saving the maintenance cost.
- The design of passive cooling (heat dissipation without the air-conditioner or fans) meets the energy-saving requirement.

2.6 Software Architecture

The software of the MA5662 consists of four planes: system support plane, system service plane, system management plane, and service control plane.

Figure 2-9 shows the host software architecture of the MA5662.

Figure 2-9 Software architecture of the MA5662



The functions of the four planes are as follows:

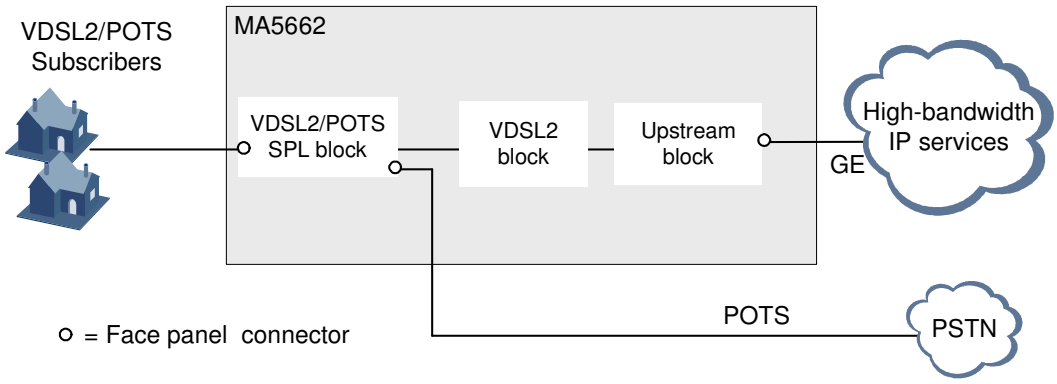
- System support plane: drives the hardware system.
- System service plane: provides the basic operating service for the software operation, and manages the system equipment. The basic functional module of the system service plane is the operating system.
- System management plane: provides the functions of device and service management.
- Service control plane: the core module that provides the following service functions:
  - Resolves and processes the service configuration commands.
  - Implements protocol processing between devices.
  - Processes service requests.
  - Provides required services for the users.

2.7 VDSL2 Functional Block

Functional Block Diagram

The MA5662 supports the VDSL2 access that is compatible with ADSL, ADSL2, and ADSL2+ access to provide high-bandwidth voice, data, and video services. Figure 2-10 shows the major functional blocks for high-bandwidth IP services for xDSL subscribers.

Figure 2-10 Functional block diagram for high-bandwidth IP services for xDSL subscribers



Standards Compliance

VDSL2 can provide subscribers with higher bit rates compared with multi-ADSL. The bit rate supported depends on a variety of factors including port configuration, modem, line noise, and loop quality. In 536 m (3000 ft.) of 26 AWG loop and nose conditions, the rate can reach over 4 Mbps upstream and 28 Mbps downstream.

The MA5662 complies with the VDSL2-related standards, including:

- ITU-T 993.2 Annex A used in North America
- ITU-T 993.2 Annex B used in Europe

The MA5662 supports multiple VDSL2 profiles, including 8a, 8b, 8c, 8d, 12a, 12b, 17a.

3 Product and Application

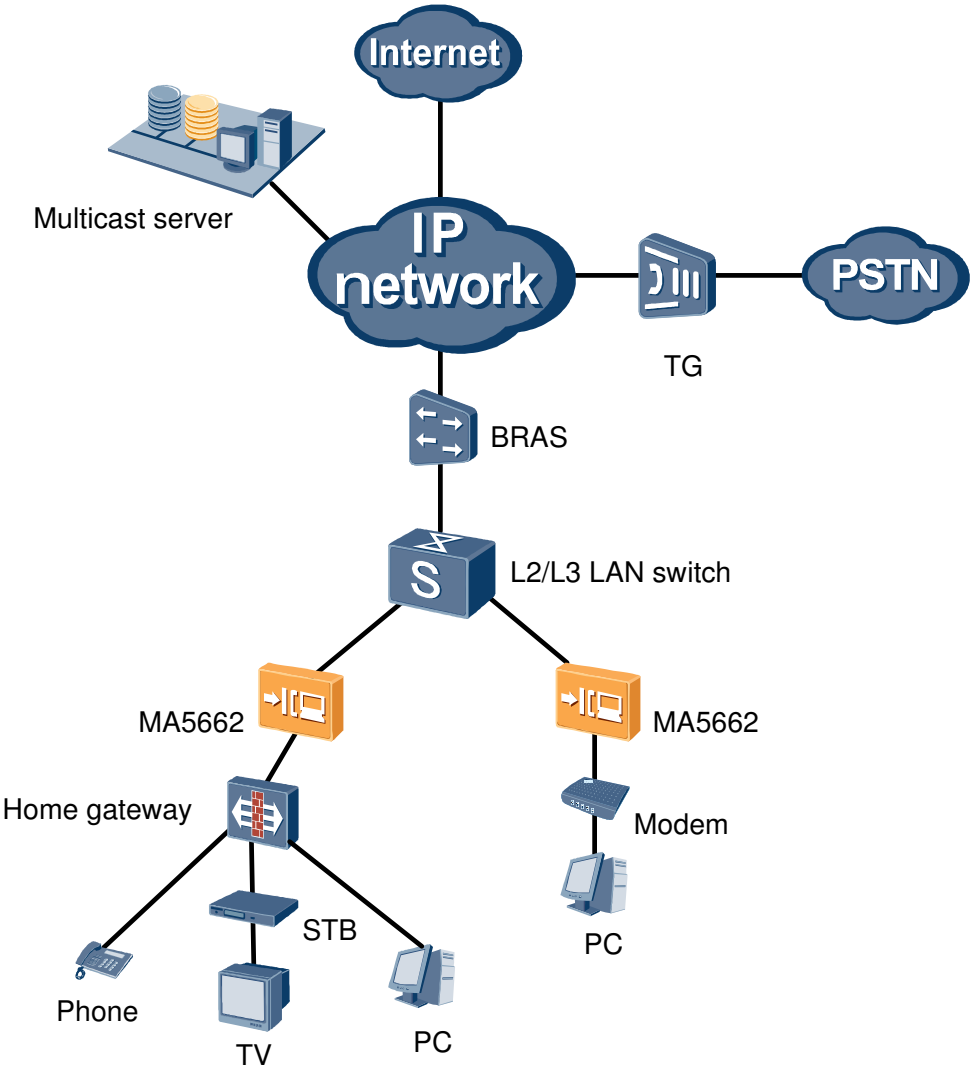
3.1 IP-DSLAM Network Application

The MA5662 supports IP-DSLAM network application, and provides the broadband access service, for example, HSI service, for the subscriber.

Network Application

Figure 3-1 shows the network application of the IP-DSLAM.

Figure 3-1 Network application of the IP-DSLAM



Network Description

In the network:

- The MA5662 provides GE optical port for transmitting data upstream to the convergence switch.
- The MA5662 can access VDSL2 (compatible with ADSL/ADSL2/ADSL2+) subscribers.

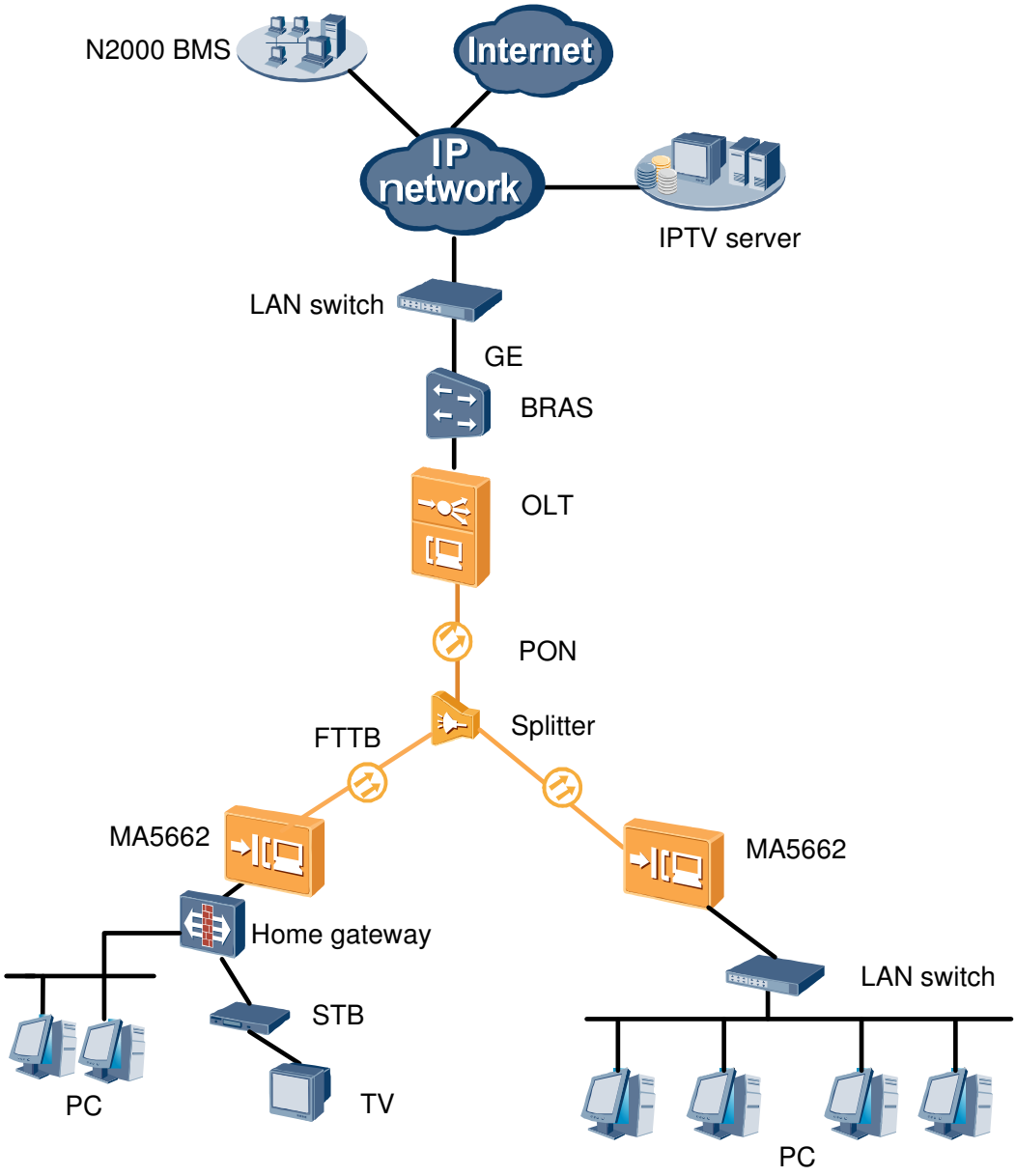
3.2 FTTB Network Application

The MA5662 supports FTTB network application to provide access service for community subscribers.

Network Application

Figure 3-2 shows the FTTB network application.

Figure 3-2 FTTB network application



Network Description

For data services: The PC accesses the OLT through the MA5662. The MA5662 transmits data upstream to the OLT through the GPON port. The OLT accesses the IP network upstream.

For video service:

- The IPTV mode can be used to provide terminal users with video services.

- The video service is delivered over the IP multicast traffic, providing subscribers with various program sources. The MA5662 and OLT separately manage the multicast user rights and the programs through IGMP Proxy and controllable multicast. After the MA5662 and OLT authenticate a multicast user, the IGMP packets of the multicast user are forwarded by the OLT to the convergence layer device.
- The video server transmits the video service traffic to the MA5662 through the backbone network and the convergence network. Then, the MA5662 forwards the traffic to the corresponding subscriber terminal based on the authentication results. On the subscriber side, the STB terminates video signals, performs media conversion, and controls program switching.

The GPON network features wide coverage, flexible networking, and low maintenance cost. Therefore, the MA5662 can work with the OLT to provide users with a high-bandwidth access service and to expand the access capacity of the OLT.

3.3 QinQ Network Application

The MA5662 supports QinQ network application. In the QinQ network application, the VLAN ID resources of the public network are saved, and the packets with private network VLAN tags can be transparently transmitted on the public network.

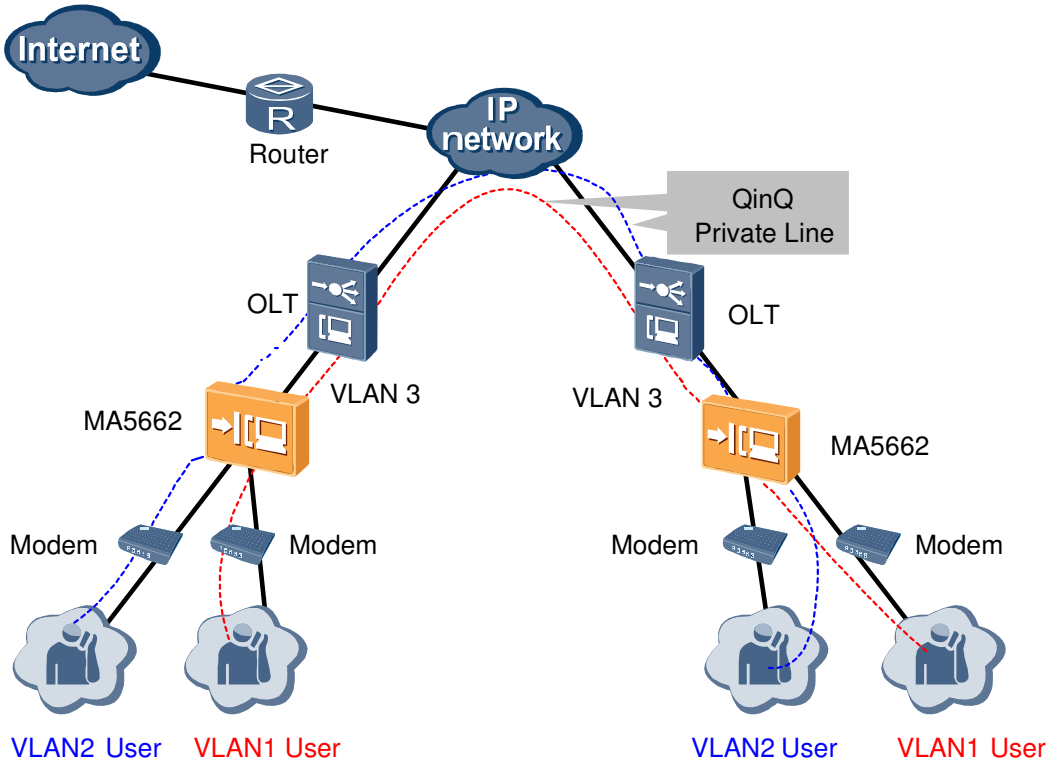
Service Description

In the QinQ network application, public VLAN IDs are allocated to the subscriber packets that carry VLAN tags. Then, the packets can be transmitted in the backbone network using the public VLAN IDs. This networking greatly saves the public VLAN ID resources and facilitates the P2P interconnection between private line subscribers across the MAN.

Network Application

Figure 3-3 shows the QinQ network application.

Figure 3-3 QinQ network application



Network Description

In the QinQ network application, the subscriber packets transmitted on the backbone network have outer and inner VLAN tags, namely, a public network tag and a private network tag. The packets are transmitted as follows:

- On the subscriber side of the MA5662:

  The subscribers of VLAN 1 and VLAN 2 are connected to the MA5662. The MA5662 allocates a public network VLAN ID (VLAN 3) to all the subscriber packets, and then transmits the packets to the upper-layer network.
- On the network side of the MA5662:

  In the backbone network, the packets are transmitted based on the public VLAN ID. After the packets reach the MA5662 on the other side of the backbone network, the MA5662 removes the public VLAN tag from the packets, and passes the packets to the user-side device.

The QinQ networking provides the user with a simple layer-2 virtual private network (VPN) channel to implements the function of transparent transmission of private VLANs and services to the peer end and to expand the private network geographically to a certain extent.

3.4 VLAN Stacking Network Application

The MA5662 supports VLAN stacking network application to implement the VLAN extension service and private line wholesale service.

Service description

Through VLAN extension, the number of VLANs can be increase and subscribers can be identified.

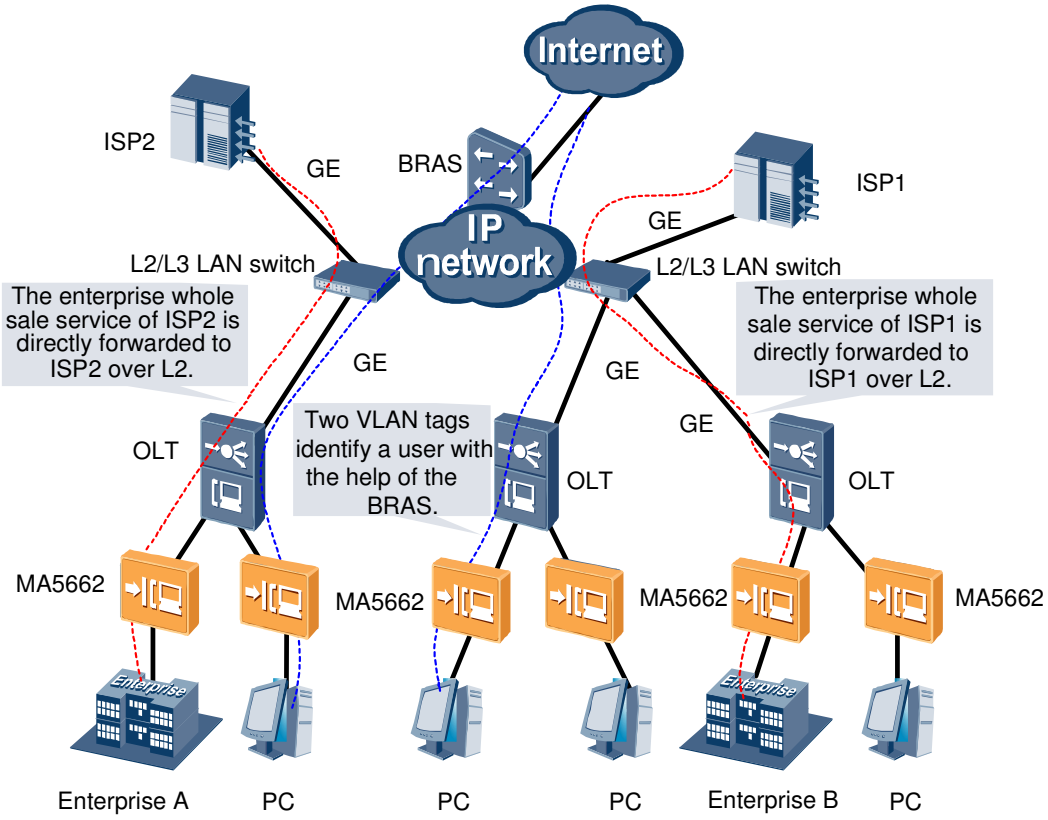
When the upper layer device works in the L2 mode, the packets are forwarded based on the VLAN ID and the MAC address.

VLAN stacking is similar to QinQ in implementation. The only difference is that the user packet of VLAN stacking is encapsulated with two VLAN tags and the user packet of QinQ is encapsulated with one VLAN tag.

Network Application

Figure 3-4 shows the VLAN stacking network application.

Figure 3-4 VLAN stacking network application



BRAS: Broadband Access Server ISP: Internet Service Provider

Network Description

In the VLAN stacking application, the BRAS must authenticate two VLAN tags (outer VLAN tag and inner VLAN tag). When a subscriber packet reaches the MA5662, the two VLAN tags are added to the subscriber packet, and then the subscriber packet is forwarded to the ISP specified by the outer VLAN tag. The inner VLAN tag identifies a user.

The VLAN stacking network application ensures that the VLANs can be reused, and realizes the multi-IPS wholesale service.

4 Device Management

4.1 Management Through the CLI

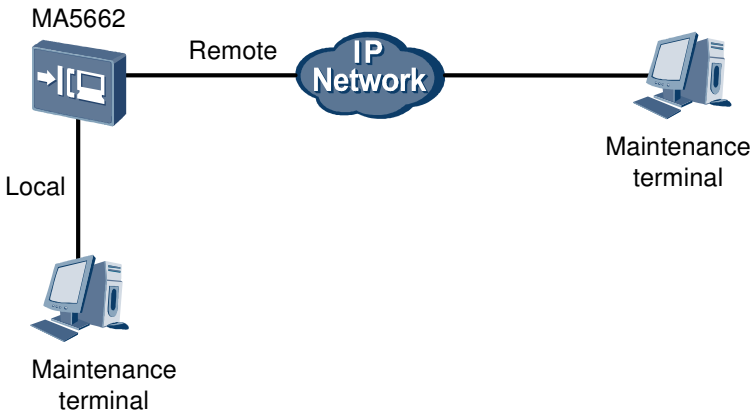
In the CLI mode, you can manage and maintain the MA5662 after logging in through a serial port or an Ethernet port (Telnet).

Management through the CLI, where the following modes are available:

- Remote maintenance through IP network
- Local maintenance

Figure 4-1 shows the network diagram for maintaining the MA5662 through the CLI.

Figure 4-1 Network diagram in the CLI mode



4.2 Management Through the NMS

You can mange, maintain, and monitor the MA5662 through the iManager U2000 Unified Network Management System (hereinafter referred to as the iManager U2000).

4.2.1 Overview of the iManager U2000

The iManager U2000 is provided by Huawei Technologies Co., Ltd. for managing a variety of network elements (NEs) of Huawei in a unified manner. The iManager U2000 communicates with the UA5000 through Simple Network management Protocol (SNMP) for the management and maintenance of the MA5662.

4.2.2 Management Functions

The iManager U2000 BMS provides abundant management functions including the security management, topology management, alarm management, performance management, existing resources management, log management, database management, NE communication parameter management, NE software management, report management, and system monitoring.

Overview

The management functions of the iManager U2000 include the following:

- Security management
- Topology management
- Alarm management
- Performance management
- Existing resources management
- Log management
- Database management
- NE communication parameter management
- NE software management
- Report management
- System monitoring

Security Management

The iManager U2000 provides the BMS security management function. It implements the authority control based on user, user group, operation set, authority, and access control list (ACL). It supports the automatic lock, forcible disconnection, and collection of user logs over the client.

Topology Management

The topology management function enables the U2000 to display the managed NEs and the connections between NEs in a topology view. In addition, the U2000 provides the submaps and various views for the NE management. By browsing the topology view, you can learn the running status of the entire network in real time. The iManager U2000 can display the NEs on the entire network in a topology view. Thus, you can monitor and manage the devices on the entire network through a unified management platform. This simplifies the operation and management (O&M) of the network and also reduces the workload for network O&M.

Alarm Management

The alarm management function enables the iManager U2000 to monitor the abnormal running conditions of the network in real time. Through the statistics collection, location, prompt, redefinition, correlation analysis, and remote notification of alarms performed by the iManager U2000, you can take troubleshooting measures to restore the network in time.

Performance Management

The iManager U2000 can monitor the key indicators of a network and provide statistics for the collected performance data. It provides a graphic user interface (GUI) for facilitating the network performance management.

Existing Resources Management

The iManager U2000 provides the existing resources management function for customers to query and collect statistics for the physical and logical resources in a unified manner.

Log Management

Log management includes the management of U2000 security logs, U2000 operation logs, and NE security logs. By querying and saving the logs periodically, you can detect unauthorized login or operations, and analyze the faults in time. Through the logs, you can obtain the information about the client from which the U2000 user logs in to the U2000 server and the operations performed by the user after the login. You can also dump or print log data.

Database Management

The iManager U2000 provides a tool for database backup and recovery. This simplifies the maintenance of the U2000 database and helps the U2000 BMS run stably and securely. Database management includes the management of NE database and the management of U2000 database. To ensure the data security, you need to back up the database periodically.

NE Communication Parameter Management

The iManager U2000 supports the configuration of the parameters for the communication between the U2000 and the NE. This ensures that the U2000 and the NE communicate with each other normally.

NE Software Management

The iManager U2000 provides the function of managing the NE software and database, such as upgrading the software, installing the patch, configuring the data periodically, and manually restoring the data.

Report Management

The U2000 supports the iWeb report function that enables the system to provide customers with reports about alarms, logs, and resources. You can print the report or save the report as a file when viewing the report data. Reports that are displayed as tables can be filtered by device type, and can be saved as files in Excel format.

System Monitoring

The iManager U2000 provides the system monitoring tool. By using the tool, you can monitor and maintain the system through the GUI.

5 Technical Specifications

5.1 Device Parameters

This topic provides the information about the device dimensions, device weight, running environment, power supply, and power consumption parameters of the MA5662 as shown in Table 5-1, Table 5-2, Table 5-3, Table 5-4, and Table 5-5.

Device Dimensions

Table 5-1 Dimensions of the MA5662

Dimension	Specifications
Wideth	420 mm (16.54 in.)
Depth	152 mm (5.98 in.)
Height	545 mm (21.46 in.)

Device Weight

Table 5-2 Weight of the MA5662

Component	Weight
Integrated sealed cabinet with no cables	18 kg (39.68 lb)

Running Environment

Table 5-3 Environmental parameters of the MA5662

Parameter	Specifications
Ambient working temperature	–40°C to +70°C

Parameter	Specifications
Ambient working humidity	5% RH to 100% RH
Air pressure	70 kPa to 106 kPa
Altitude	≤ 2000 m (1.2 miles)

Power Supply

Table 5-4 Power supply parameters of the MA5662

Power Supply	Parameter	Working Voltage Range
Three-in-one power supply **CAUTION** The use of any two power supply modes at the same time is forbidden.	Local DC	–48 V (–38.4 V to –72V)
	Local AC	110 V or 220 V (90 V–264 V)
	Remote DC	±190 V (140 V–380 V)

Power Consumption

Table 5-5 Power consumption of the MA5662 chassis

Upstream Mode	Static Power Consumption	Maximum Power Consumption
GE upstream,	46 W	100 W
GPON upstream	46 W	102 W

5.2 Performance and Capacity

Switching Rate

Table 5-6 Switching rate of the MA5662 software system

Parameter	Value
System switching rate	2.8 Gbit/s

System Capacity

Table 5-7 Maximum capacity of the MA5662 ANSI shelf

Port Type	Specifications
VDSL2 access port	48
GE upstream port	2

Table 5-8 Maximum capacity of the MA5662 ETSI shelf

Port Type	Specification
VDSL2 access port	48
GE upstream port	1
GPON upstream port	1

5.3 Service and Management Feature

5.3.1 Service Feature and Specifications

Table 5-9 lists the service specifications of the MA5662.

Table 5-9 Service feature and specifications of the MA5662

Category	Feature	Specifications
MAC address	Address self-learning	• The MA5662 complies with IEEE 802.1d. • The MA5662 supports managing the maximum number of learnable MAC addresses based on the traffic stream. • The MA5662 supports configuring and managing dynamic and static MAC addresses.
	Number of address entries	4096
VLAN	Number of VLANs of the entire system	2048
	Standard VLAN	The MA5662 supports: • VLAN trunk • Port-based VLAN • 802.1p-based VLAN

Category	Feature	Specifications
	Smart VLAN	• One VLAN corresponds to multiple service ports. • The smart VLAN application at the layer 2 is supported.
	MUX VLAN	• One VLAN corresponds to one service port. • The MUX VLAN application at the layer 2 is supported.
	QinQ VLAN	• The packets with a VLAN tag are added with an outer VLAN tag. • The VLAN QinQ priority can be configured.
	VLAN Stacking	• The packets without a VLAN tag are added with inner and outer VLAN tags. • By default, the C-VLAN ID and priority at the user side are adopted for the inner VLAN and priority of a traffic stream. • The MA5662 supports VLAN stacking management based on the port or traffic stream.
Multicast	Multicast protocol	The MA5662 supports: • IGMP V2, V3 • IGMP Proxy • IGMP Snooping
	Performance and Features	• 4096 multicast channels • 1000 concurrent multicast streams of the system • 32 concurrent multicast streams of each user • Multicast bandwidth management (multicast CAC for user side) • Multicast Charging Data Record (CDR) for audience statistics • Fast zapping
	Multicast	• Multicast based on VLAN • Multicast statistics compliant with TR-101
Protocol adaptation function	PPPoA to PPPoE IPoA to IPoE	• PPPoE over ATM to PPPoE • IPoE over ATM to IPoE • IP over ATM to IPoE • PPP over ATM to PPPoE • Protocol encapsulation auto-sensing

Category	Feature	Specifications
QoS	Flow classification	Flow classification is based on the following parameters: • Source and destination MAC addresses • Source/destination IP address • Source/destination port number • Protocol type
	IEEE 802.1p	• Packet forwarding based on the 802.1p priority • Re-marking of the 802.1p or CoS priority • Flexible mapping between the CoS priorities and scheduling queues • Rate limiting based on the port and CoS priority • Re-marking of the two-rate three-color marker (trTCM) priority
	Congestion control	Supported
	CAR	• CAR based on the user PVC • Separate CAR for upstream and downstream traffic • The granularity is 64 Kbit/s. The minimum is 64 Kbit/s and the maximum is 128 Mbps.
	Queue scheduling	• Eight queue priorities • SP scheduling • WRR scheduling • SP + WRR scheduling
Security	L2 subscriber isolation	L2 PVC/VLAN isolation
	IP address binding	• Management of the bound IP addresses based on the traffic stream. • Binding of "IP address + MAC address + service ports". Each service port can be bound with up to eight IP addresses and eight MAC addresses.
	MAC address number control	The number of MAC addresses for each user is in the range of 1–255.
	MAC address table query	Locating a user port quickly by MAC address
	Multicast group control	Restriction on the number of multicast groups that each user can join

Category	Feature	Specifications
	Broadcast suppression	• Suppression of broadcast packets, unknown unicast packets, and unknown multicast packets • Traffic adjustment by the traffic percentage
	DHCP Option82	During the Set Top Box (STB) authentication, the user port information can be contained in the DHCP message and sent to the DHCP server or BRAS.
	PPPoE Relay Agent (PPPoE+)	During PPPoE authentication, the user port information can be contained in the PPPoE message and sent to the BRAS.
	IEEE 802.1X	Supported
DSL	VDSL2	• VDSL2 profiles (8a, 8b, 8c, 8d, 12a, 12b, 17a) • ITU-T G.993.2 Annex A • ITU-T G.993.2 Annex B • Up to 2.5 Gbit/s switching capacity between backplane bus and VDSL2 card
Others	MSTP (compatible with STP/RSTP)	Compliant with IEEE 802.1w
	ANCP	The MA5662 interacts with the BRAS through the Access Node Control Protocol (ANCP), thus realizing xDSL line configuration, OAM, and topology discovery of the device ports.
	Port mirroring	GE port mirroring

5.3.2 System Maintenance and Management Feature

Table 5-10 lists the system maintenance and management specifications of the MA5662.

Table 5-10 System maintenance and management specifications of the MA5662

Category	Specifications
Management	Console configuration
	SSH/Telnet remote configuration
	CLI configuration
	SNMPv1, SNMPv2, and SNMPv3 management
	Management through the NMS
	System log

Category	Specifications
	Hierarchical alarms
Maintenance	Output of debugging information
	Ping
	Trace Route
	SSH/Telnet remote maintenance
Loading and upgrading	Loading and upgrading through Xmodem
	Loading and upgrading through SSH, FTP, TFTP, or SFTP
	• Loading and upgrading upon startup • In-service loading and upgrading • Automatic reporting of the alarms, logs, and data to the FTP server
Performance statistics	Multicast streams, multicast VLAN packets, and multicast user packets
	VLAN traffic streams and network flow
	Number of packets and flow of the Ethernet port
	Cell flow and byte flow of the service port
	Line performance, flow, and abnormal flow of the VDSL2 port
	VDSL2 CO-side line, user-side line, CO-side abnormity, user-side abnormity and traffic
	GPON line performance

6 Protocols and Standards

6.1 Communication Protocols

This topic describes communication protocols of MA5662.

Ethernet Protocols

Table 6-1 Ethernet protocols supported

Standard	Description
IEEE 802.1Q	IEEE standard for local and metropolitan area networks Virtual Bridged Local Area Networks
IEEE 802.1s	MSTP (compatible with STP and RSTP)
IEEE 802.1x	Standard for Port based Network Access Control
IEEE 802.3x	Full Duplex operation in a switched LAN
IEEE 802.3ad	Link Aggregation (Trucking)
IEEE 802.3u	Ethernet MIB
IEEE 802.3z	1000BASE-X

Encapsulation Protocols

Table 6-2 Encapsulation protocols supported

Standard Number	Description
RFC1483	Multi-protocol Encapsulation over ATM Adaptation Layer 5
RFC2684	Multi-protocol Encapsulation over ATM Adaptation Layer 5
RFC1626	Default IP MTU for use over AAL5
RFC1661	Point to Point Protocol (PPP)

Standard Number	Description
RFC2516	PPPoE
RFC2364	PPPoA
RFC1577	Classical IP and ARP over ATM
RFC2225	Classical IP and ARP over ATM
RFC2236	IGMP V2
RFC3376	IGMP V3
TR-101	PPPoE+, DHCP Option82

xDSL Protocols

Table 6-3 xDSL protocols supported

Standard	Description
ITU-T G.993.2	"Very high speed digital subscriber line 2" and amendment 1-3
ITU-T G.994.1	Handshake procedures for Digital Subscriber Line (DSL) transceivers
ITU-T G.997.1	Physical Layer Management for Digital Subscriber Line (DSL) Transceivers
GR-834-CORE	Network Maintenance: Access and Testing Messages
ANSI T1.TRQ-10-2003	Technical Requirement on Splitters used for Line Splitting and Line Sharing Applications.
ANSI T1.PP.413-2004	Network to Customer Installation Interfaces - Asymmetric Digital Subscriber Line (ADSL) Metallic Interface, 2004.

DSL Forum Protocols

Table 6-4 DSL forum protocols supported

Standard	Description
TR-034	Alternative OAM Communications Channel Across the U interface
TR-037	Auto-Configuration for the Connection Between the DSL Broadband Network Termination (B-NT) and the Network using ATM
TR-048	Test specifications (DSL Forum)
TR-056	Network Migration to Next Generation DSL Networks
TR-058	Multi-Service Architecture & Framework Requirements

Standard	Description
TR-059	DSL Evolution - Architecture Requirements for the Support of QoS Enabled IP Services
TR-066	DSL Network Element Management
TR-101	Technical Report DSL Forum TR-101 Migration to Ethernet-Based DSL Aggregation
TR-129	Protocol-Independent Management Model for Next Generation DSL Technologies
WT-114	G.VDSL2 Performance Test Plan
WT-115	G.VDSL2 Functionality Test Plan
WT-147	Layer 2 Control Mechanism

GPON Protocols

Table 6-5 GPON protocols supported

Standard	Description
ITU-T G.984.1	General characteristics for Gigabit-capable Passive Optical Networks (GPON)
ITU-T G.984.2	Gigabit-capable Passive Optical Networks (GPON): Physical Media Dependent (PMD) layer specification
ITU-T G.984.3	Gigabit-capable Passive Optical Networks (G−PON): Transmission convergence layer
ITU-T G.984.4	Gigabit-capable Passive Optical Networks (GPON): ONT management and control interface specification
ITU-T G.983.3	A broadband optical access system with increased service capability by wavelength allocation
ITU-T G.983.3 Amendment 1	A broadband optical access system with increased service capability by wavelength allocation

IP Protocols

Table 6-6 IP protocols supported

Standard	Description
RFC768	UDP protocol
RFC783	The TFTP Protocol (Revision 2)

Standard	Description
RFC791	IP protocol
RFC792	ICMP protocol
RFC793	TCP protocol
RFC826	ARP
RFC854	Telnet protocol
RFC894	Standard for transmitting IP packet on Ethernet
RFC2131	DHCP
RFC1858	Security Considerations for IP Fragment Filtering
RFC2474	Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers
RFC2475	An Architecture for Differentiated Services, including edge-conditioning functions such as Packet Classification, Policing, Shaping, Marking & Metering
RFC2865	Remote Authentication Dial In User Service (RADIUS)
RFC2869	RADIUS Extensions
RFC959	FTP
RFC1112	IGMPv1
RFC2236	IGMPv2
RFC3376	IGMPv3
RFC1305	NTP

OAM Protocols

Table 6-7 OAM protocols supported

Standard	Description
RFC1155	Structure and identifier of the Internet management information based on TCP/IP
RFC1157	Simple Network Management Protocol (SNMP)
RFC1213	Internet Network Management Information Base based on TCP/IPMIB-II
RFC1212	Concise MIB Definitions
RFC1757	Remote Network Monitoring Management Information Base
RFC1906	Transport Mappings for Version 2 of the Simple Network

Standard	Description
	Management Protocol (SNMPV2)
RFC1907	Management Information Base for Version 2 of the Simple Network Management Protocol (SNMPV2)
RFC2571	An Architecture for Describing SNMP Management Frameworks
RFC2572	Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)
RFC2573	SNMP Applications
RFC1643	Definitions of Managed Objects for the Ethernet-like Interface Types
RFC2662	Definitions of Managed Objects for DSL lines
GR-474-CORE	Network Maintenance, Alarm and Control
RFC2578	Structure of Management Information Version 2 (SMIV2)
RFC2662	Definitions of Managed Objects for the ADSL Lines
RFC2819	Remote Network Monitoring
IEEE 802.1ag	Connectivity Fault Management
IEEE 802.3ah	Media Access Control Parameters, Physical Layers, and Management Parameters for Subscriber Access Networks
TR-090	Protocol Independent Object Model for Managing Next Generation ADSL Technologies

6.2 Standards Compliance

This topic provides the environment adaptability standards, electromagnetism compatibility standards, and safety standards of the MA5662.

Environment Adaptability Standards

Table 6-8 North American environment adaptability standards supported

Standard	Description
GR-3108-CORE	Generic Requirements for Network Equipment in the Outside Plant (OSP), Issue 1, July 2004.
GR-487	Generic Requirements for Electronic Equipment Cabinets
IEC 60529	Degrees of protection provided by enclosures (IP Code)
GR-3108-CORE	Generic Requirements for Network Equipment in the Outside Plant (OSP), Issue 1, July 2004.

Standard	Description
GR-487	Generic Requirements for Electronic Equipment Cabinets

Table 6-9 European environment adaptability standards supported

Standard	Description
ETS 300 019 1-1, Class 1.2	Environmental conditions and environmental tests for telecommunications equipment; Part 1-1: Classification of environmental conditions; Storage
ETS 300 019-2-1 V2.1.2	Environmental conditions and environmental tests for telecommunications equipment; Part 2-1: Specification of environmental tests; Storage, 2000-09
IEC 60529	Degrees of protection provided by enclosures (IP Code)

Electromagnetism Compatibility Standards

Table 6-10 North American electromagnetism compatibility standards supported

Standard	Description
GR-1089-CORE	Electromagnetic Compatibility and Electrical Safety - Generic Criteria for Network Telecommunications Equipment, Issue 4, June 2006.
FCC-Part 15A	Federal Communication Committee - part 15- radio frequency device
GR-513-CORE	LSSGR: Power, Issue 1, September 1995.
ANSI T1.315-2001	Voltage Levels for DC-Powered Equipment Used in the Telecommunications Environment (Revision of T1.315-1994), 2006.
IEC 61000-4-2	Electromagnetic compatibility-Part 4-2: Testing and measurement techniques-Electrostatic discharge immunity test
IEC 61000-4-3	Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques-Radiated, radio-frequency, electromagnetic field immunity test
IEC 61000-4-4	Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques-Electrical fast transient/burst immunity test
IEC 61000-4-5	Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques-Surge immunity test

Standard	Description
IEC 61000-4-6	Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques-Immunity to conducted disturbances, induced by radio-frequency fields
ITU-T K.20	Resistibility of telecommunication equipment installed in a telecommunications center to overvoltages and overcurrents
CISPR 22	Information technology equipment-Radio disturbance characteristics-Limits and methods of measurement
CISPR24	Information technology equipment-immunity characteristics - limits and methods of measurement
ITU-T K.32	Immunity requirements and test methods for electrostatic discharge to telecommunication equipment - Generic EMC Recommendation
ITU-T K.44	SERIES K: PROTECTION AGAINST INTERFERENCE Resistibility test for telecommunication equipment exposed to overvoltages and overcurrents - Basic recommendation
GR-1089-CORE	Electromagnetic Compatibility and Electrical Safety - Generic Criteria for Network Telecommunications Equipment, Issue 4, June 2006.
FCC-Part 15A	Federal Communication Committee - part 15- radio frequency device
GR-513-CORE	LSSGR: Power, Issue 1, September 1995.

Table 6-11 European electromagnetism compatibility standards supported

Standard	Description
ETSI EN 300 386 V1.3.2	Electromagnetic compatibility and Radio spectrum Matters (ERM);Telecommunication network equipment; ElectroMagnetic Compatibility (EMC) requirements - Class B(emissions), 2003-05
IEC 61000-4-2	Electromagnetic compatibility-Part 4-2: Testing and measurement techniques-Electrostatic discharge immunity test
IEC 61000-4-3	Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques-Radiated, radio-frequency, electromagnetic field immunity test
IEC 61000-4-4	Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques-Electrical fast transient/burst immunity test
IEC 61000-4-5	Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques-Surge immunity test

Standard	Description
IEC 61000-4-6	Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques-Immunity to conducted disturbances, induced by radio-frequency fields
ITU-T K.20	Resistibility of telecommunication equipment installed in a telecommunications center to overvoltages and overcurrents
CISPR 22	Information technology equipment-Radio disturbance characteristics-Limits and methods of measurement
CISPR24	Information technology equipment-immunity characteristics - limits and methods of measurement
ITU-T K.32	Immunity requirements and test methods for electrostatic discharge to telecommunication equipment - Generic EMC Recommendation
ITU-T K.44	SERIES K: PROTECTION AGAINST INTERFERENCE Resistibility test for telecommunication equipment exposed to overvoltages and overcurrents - Basic recommendation

Safety Standards

Table 6-12 North American safety standards supported

Standard	Description
GR-63-CORE	NEBS™ Requirements: Physical Protection, Issue 3, March 2006.
UL 50	Standard for Safety Enclosures for Electrical Equipment, Non-Environmental Considerations
UL 60950-1	Information technology equipment –Safety –Part 1:General requirements, 2003
SR-332	Reliability Prediction Procedure for Electronic Equipment, Issue 2, September 2006.
IEC 60825-1	Safety of laser products - Part 1- Equipment classification, requirement and user's guide
IEC 60825-2	Safety of laser products - Part 2- Safety of optical fiber communication
IEC 60950-1	Information Technology Equipment - safety - Part 1: General Requirements
IEC 60950-22	Information technology equipment - Safety - Part 22: Equipment to be installed outdoors

Table 6-13 European safety standards supported

Standard	Description
SR-332	Reliability Prediction Procedure for Electronic Equipment, Issue 2, September 2006.
IEC 60825-1	Safety of laser products - Part 1- Equipment classification, requirement and user's guide
IEC 60825-2	Safety of laser products - Part 2- Safety of optical fiber communication
IEC 60950-1	Information Technology Equipment - safety - Part 1: General Requirements
IEC 60950-22	Information technology equipment - Safety - Part 22: Equipment to be installed outdoors

A Acronyms and Abbreviations

A	
AAA	Authentication, Authorization and Accounting
AAL5	ATM Adaptation Layer type 5
ACL	Access Control List
ADSL	Asymmetric Digital Subscriber Line
ADSL2	Asymmetric Digital Subscriber Line 2
ADSL2+	Asymmetric Digital Subscriber Line 2 plus
ANCP	Access Node Control Protocol
ANSI	American National Standard Institute
ARP	Address Resolution Protocol
ATM	Asynchronous Transfer Mode
B	
BRA	Basic Rate Access
BRAS	Broadband Remote Access Server
BITS	Building Integrated Timing Supply System
C	
CAR	Committed Access Rate
CLI	Command Line Interface
CLP	Cell Loss Priority
CO	Central Office
CON	Console
CS	Convergence Sublayer

CTC	Common Transmit Clock
CTD	Cell Transfer Delay
D	
DBA	Dynamic Bandwidth Allocation
DC	Data Center
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name Server
DoS	Denial of Service
DSLAM	Digital Subscriber Line Access Multiplexer
E	
EMS	Element Management System
ETSI	European Telecommunications Standards Institute
F	
FE	Fast Ethernet
FTP	File Transfer Protocol
FTTB	
G	
GE	Gigabit Ethernet
GPON	Gigabit-capable Passive Optical Network
H	
HSI	High Speed Internet
I	
IEEE	Institute of Electrical and Electronics Engineers
IGMP	Internet Group Management Protocol
IP	Internet Protocol
IPoA	Internet Protocols over ATM
IPoE	Internet Protocols over Ethernet

IPTV	Internet Protocols Television
ISP	Internet Service Provider
L	
LACP	Link Aggregation Control Protocol
LAN	Local Area Network
M	
MAC	Media Access Control
MCB	Miniature Circuit Breaker
MSTP	Multiple Spanning Tree Protocol
N	
NE	Network Element
NGN	Next Generation Network
NMS	Network Management Station
NTP	Network Time Protocol
O	
OAM	Operation, Administration and Maintenance
OSP	Outside Plant
OSPF	Open Shortest Path First
OSS	Operation Support System
P	
PITP	Policy Information Transfer Protocol
PPP	Point to Point Protocol
PPPoA	PPP over ATM
PPPoE	PPP over Ethernet
PSTN	Public Switched Telephone Network
Q	
QoS	Quality of Service

R	
RADIUS	Remote Authentication Dial in User Service
RFC	Requirement for Comments
RFT-C	Remote feeding telecommunication circuit - Current
RFT-V	Remote feeding telecommunication circuit - Voltage
RSTP	Rapid Spanning Tree Protocol
RTCP	Real Time Control Protocol
RTP	Real Time Protocol
S	
SNMP	Simple Network Management Protocol
SPL	Splitter
STB	Set Top Box
SSH	Secure Shell
T	
TCP	Transmission Control Protocol
TFTP	Trivial File Transfer Protocol
ToS	Type of Service
U	
UDP	User Datagram Protocol
V	
VDSL	Very high rate Digital Subscriber Line
VDSL2	Very high rate Digital Subscriber Line
VLAN	Virtual Local Area Network
VoIP	Voice over IP
VOD	Video on Demand
W	
WRR	Weighted Round Robin

B Glossary

CON port	A port that is connected to a console through a serial cable for local or remote maintenance. One is an RJ-45 port on the SCUN card, and the other is a DB-9 port on the CITB card.
N	
NMS	iManager U2000 Unified Network Management System that Huawei developed
X	
xDSL	A general term that is used to refer to more than one type of DSL (for example, ADSL, ADSL2, VDSL2).